

# THE

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Samuel Thompson's Rolling Mill



## **An Overview of Early American Coinage Technology (Continued)**

**by J. C. Spilman**

### **The Rolling Mill**

Our earlier discussions have assumed the availability of copper material to be cut into planchets and stamped on the Fly to result in the finish coinage. There is substantial evidence, however, that the production of copper strip for use in the cutting press was one of the major problems confronting early American mintmasters. The lack of copper for his presses was the final straw that broke the back of James Jarvis' Fugio franchise with the United States government in 1787-1788.<sup>14</sup>

Having the copper on hand was essential, but it was equally necessary that the copper be of correct thickness to accommodate the technological restraints imposed by planchet cutting tools and coinage dies in arriving at a finished coin that would meet the authorized weight requirements.<sup>15</sup> The diameter of the coinage dies, the diameter of the planchet cutting tool and the thickness of the copper were all interrelated factors. The diameter of the coinage dies was primarily an esthetic factor. If the diameter of the dies was "too large" (or a planchet "too small") then the finished coin would usually appear to be struck off center with some portion of the design or edge pattern missing. On the other hand "too large" a planchet might also be "too thin" for proper metal flow during striking and would fail to properly strike up the design. The construction of the telescoping scissors edge planchet cutter was such that it could not be easily modified, and, with continued use and forge resharpener it would tend to become slightly smaller in diameter and would therefore produce slightly smaller planchets. From a practical point of view this meant that the mintmaster had but one readily controllable parameter, and that parameter was the thickness of his copper. Keep in mind that the weight of the coin was important because the value of a copper in commerce was determined by the intrinsic value of the metal itself.

As a result of these circumstances, the third essential mechanical component of an early American mint and of equal importance with the coinage and planchet presses was the rolling mill.

On the frontispiece of this issue is Samuel Thompson's sketch of his rolling mill. This is a man-powered machine requiring two men to turn the hand cranks on the rollers while a third person fed the material between the rollers. The frame of the machine is elevated on a heavy platform support structure, probably wood, with massive floor braces on each side. As with most man-powered machines of that era, the device is configured to accommodate the men supplying the power and not the machine "operator" who - in this case - sits or stands on an elevated location on the far side. Compare this with the operators position on a large Fly where he must sit inside of a floor pit in order to reach the dies!

<sup>14</sup> See page 811 for notes.

On the rolling mill note in particular the adjustment screws "E" and "F" connected to the upper roller. These are used to adjust the gap between the rollers and thus the final thickness of the metal strip. Directly below the sketch of the rolling mill is "Figure 2nd" which is a view of a gauge for determining the exact thickness of the strip issuing from the rollers and permitting adjustment of "E" and "F" to obtain a specific thickness. Thompson says that this machine is equipped with "polished steel rollers"!

Thompson's manuscript covers the production of gold, silver and copper coinage, in that order. In the case of gold and silver Thompson starts with "standard" gold and silver as received from an assayer or silversmith, melts the metal and casts it into ingots "twelve inches long, a quarter of an inch thick, and somewhat broader than a guinea." These ingots are then rolled between cast iron rollers via a horsepowered mechanism until a thickness is reached where it can be worked by the manpowered roller which "has polished steel rollers."

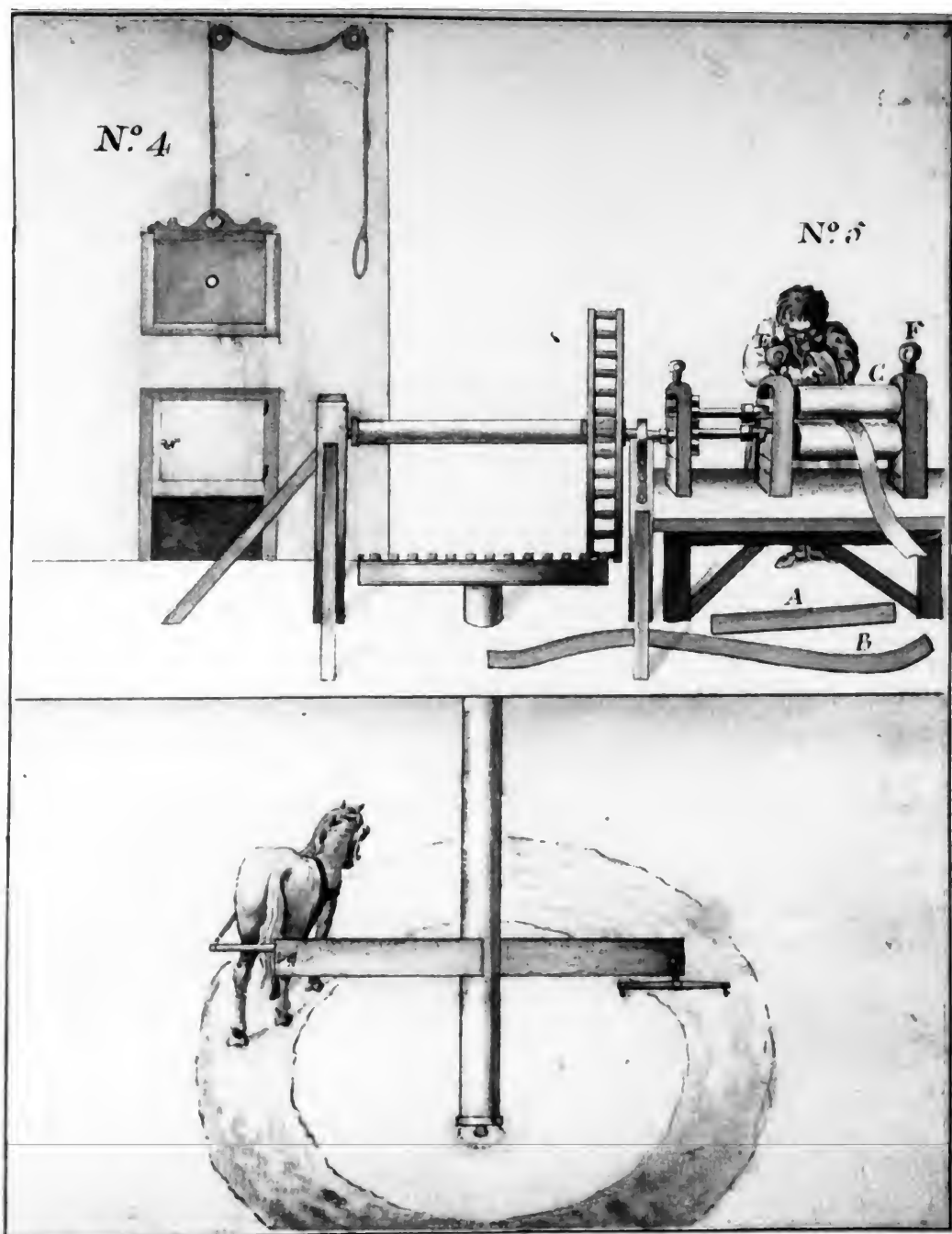
In the case of copper coinage Thompson proposed to purchase sheet copper (presumably in Dublin), slit it, anneal it, pickle it, and then roll it through the manpowered steel rollers. He describes the entire process as follows:

"The copper being bought in sheets from three to four feet square and double the thickness of half pennies, are cut into strips something broader than a halfpenny, they are nealed and put into a pickle made of salt and water to clean it. It then is brought to the steel rollers to give it a gloss and bring it to the exact thickness, then to the cutting press No. 7 to cut them."

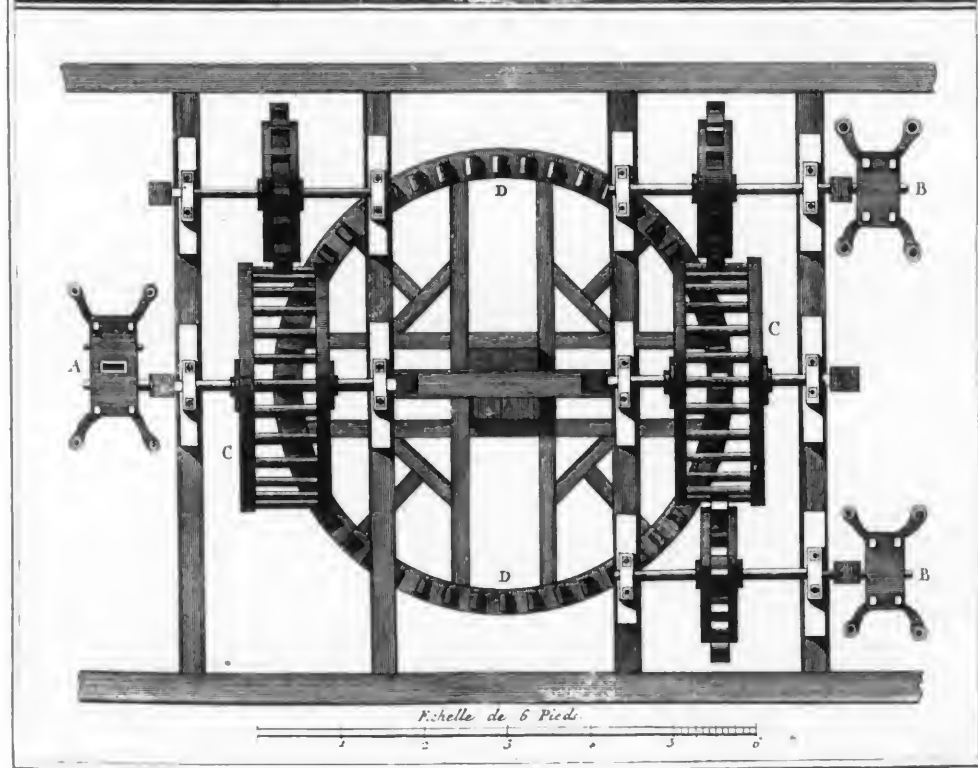
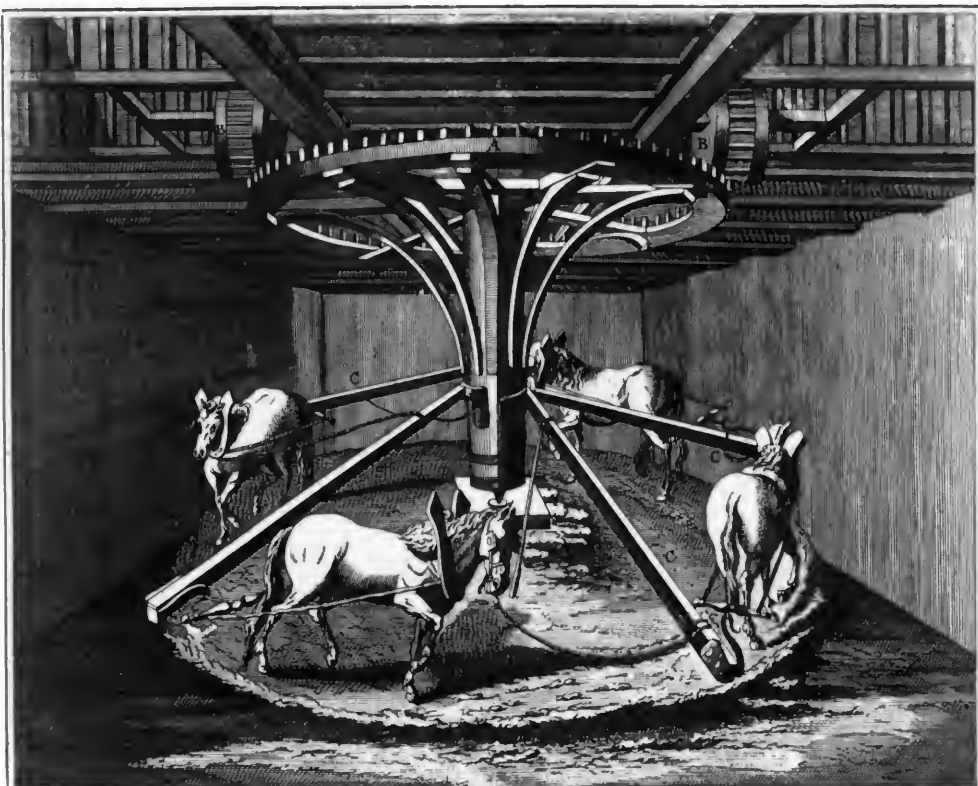
Sheet copper as described by Thompson was in common usage throughout Europe and was used for numerous applications ranging from ship bottoms to roofing and would have been readily available to a coiner. That such sheet copper would have been available in America during the 1785 to 1788 time period is highly unlikely. Much more likely would have been the use of all sorts of scrap copper remelted and poured into ingots for rolling much the same as Thompson's process where "... (copper) cuttings are melted and cast into ingots, like the gold, and so made use of."

Thompson's Sketch No. 5 (page 802) shows a horse drawn power wheel driving the cast iron rollers used to roll the ingots into strip; an annealing furnace (made of cast iron) is seen in the background. "A" is an ingot, "B" is a strip rolled from the ingot. Thompson writes "... B is a piece after it is rolled, the rolls lengthen it but makes it very little wider, every two or three times it goes through the rolls, it is necessary to neal it, or it will crack ..." In a footnote Thompson observed that "... a water wheel would be much better where it is convenient to get a water source, it works with a greater force ..."

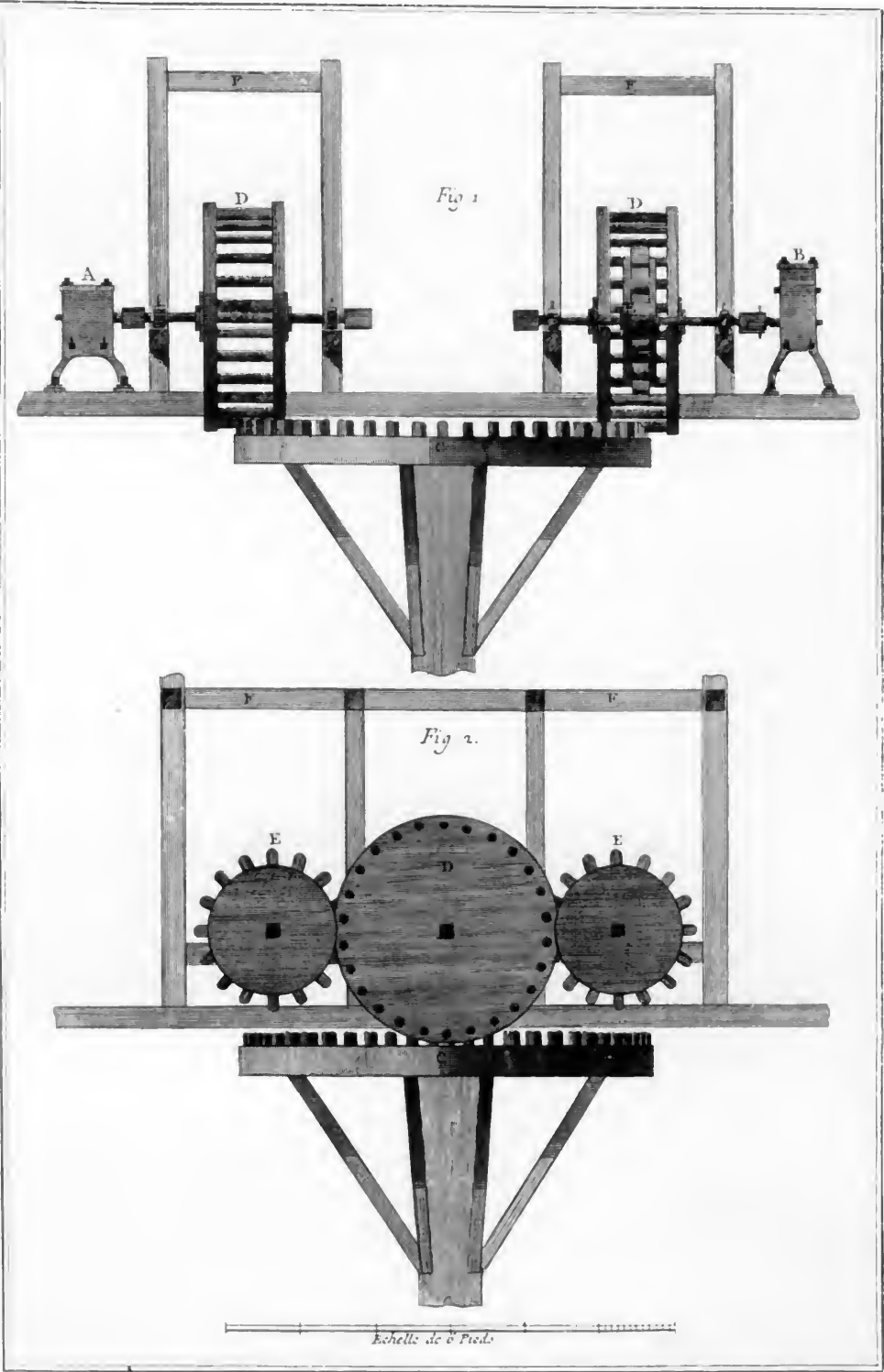
Diderot illustrates a similar four-horse driven power wheel driving a group of three rollers (located on the floor directly above the horse track) each set adjusted for a different thickness. This type of horse-driven power wheel was used for every



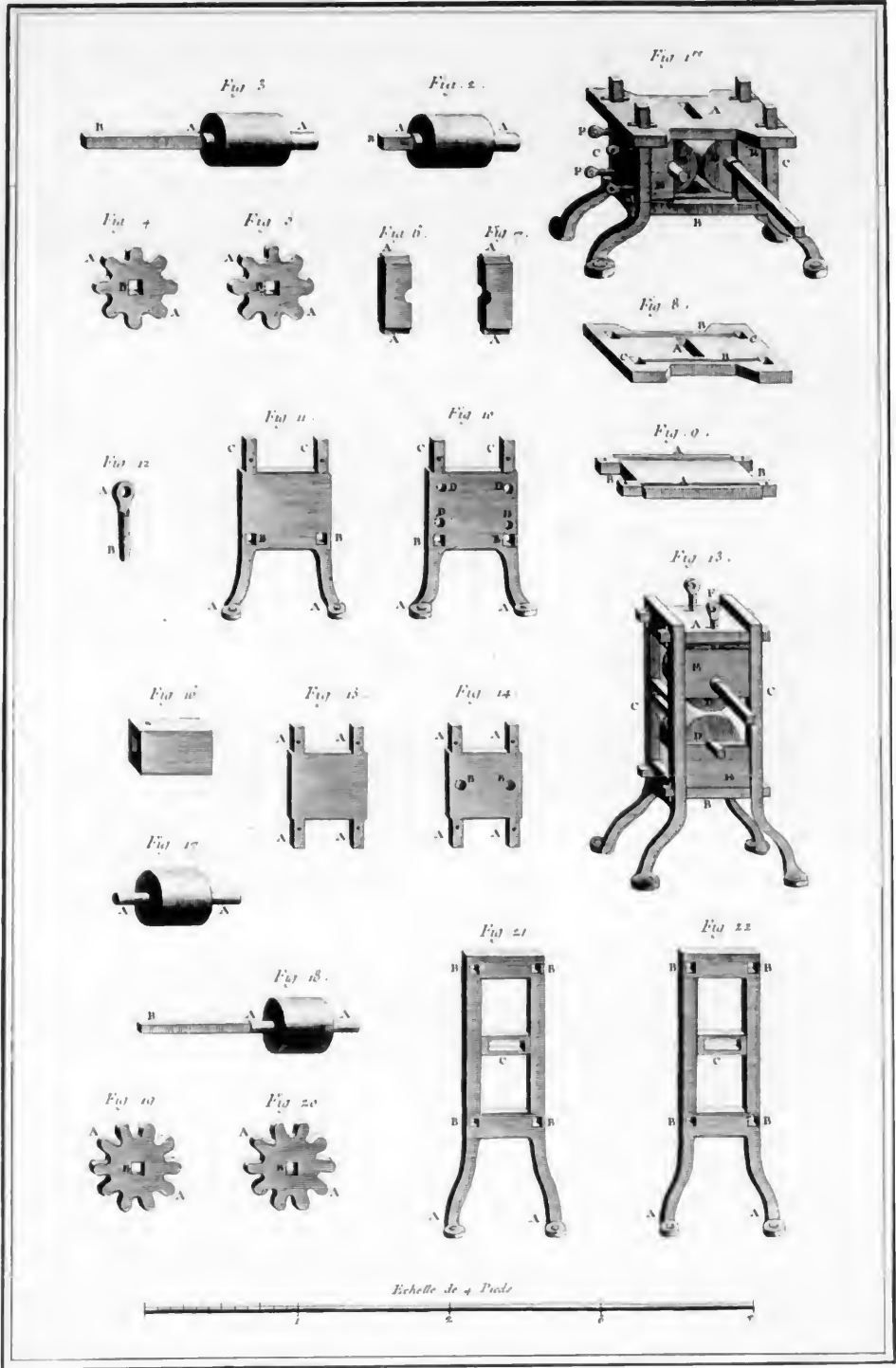
Thompson's Horse Drawn Power Wheel & Rolling Mill



Diderot's Horse Drawn Power Wheel & Rolling Mill



Gear Mechanism of Diderot’s Rolling Mill



Roller Design Details of Diderot's Rolling Mill

sort of industrial application during the 17th and 18th centuries. The vertical shaft often extended several floors above, with connecting power take-off gears on each level driving horizontal shafts connected to other devices such as grinders, trip hammers, auger lifts, etc. These shafts also powered hoist mechanisms for lifting raw materials from lower to upper levels -- the operator would engage a connecting gear to obtain power and disengage the gear when his task was completed. Extensive use was made of this basic power configuration.

Now - let us turn for a moment to a description of an early American mint - the Machin Mills located on Orange Lake in New Grange, New York. In a letter to Dr. F.B.Hough of Albany, New York, Thomas N. Machin, the son of Captain Machin, describes the operations of the coinage equipment as follows: <sup>16</sup>

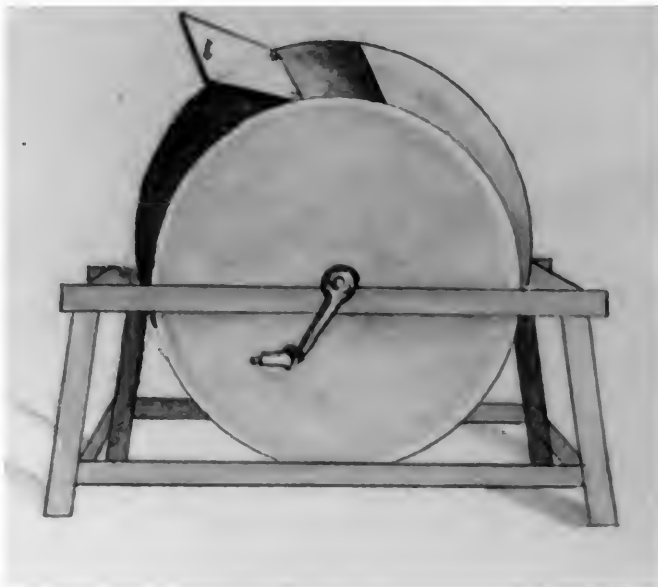
" The coinage mill was forty to fifty rods below the pond, on a canal dug for the purpose. The building was of wood, thirty by forty feet, and two stories high. The metal used was copper, obtained by melting up cannon and leaving out the zinc in the alloy. The copper was then run into moulds, and rolled into flat sheets of the thickness of the coin and from one to two feet wide. It was then punched with a screw, moved by a lever, so adjusted that half a revolution would press out a disk of the size of the coin. The blanks were then put into a cylinder and revolved with sand, saw dust and water. They were generally left revolving through the night; and the coiners circulated the story that the devil came by night to work for them. They also sometimes worked in masks to create a terror in the neighborhood. One night in the cylinder would wear the edges of the blanks smooth. The coining press was a screw, with an iron bar about ten feet long through the top. On each end of this bar was a leaden weight of perhaps five hundred pounds. The threads of the screw were large and square and worked through an iron frame. Ropes were attached to each end of the bar, and it was swung about half way around by two men pulling upon the ropes; two other men pulled the lever back, and a fifth laid on the blank and took off the coin with his fingers. The last operative named sat in a pit so that the lever would not touch his head. The coinage was about sixty per minute. A little silver was coined, but mostly copper, and the work was continued four or five years. Atlee, the engraver wore a horrid mask, and frightened some boys who came to fish so that they never ventured near the mill again. The machinery was removed to New York, and the building was afterwards used as a grist mill. Machin abandoned the enterprise probably about 1790, on the adoption of the Federal constitution."

This first hand description of the Machin operations is very similar to that described by Samuel Thompson except for the fact that Machin produced his own copper ingots and rolled copper sheet, or strips, considerably wider than did Thompson. The opening statement in the letter that "the coinage mill was forty to fifty rods below the pond, on a canal dug for the purpose " indicates the use of a waterwheel for power, as does the later statement that "... the building was later used as a grist mill." Other writers have indicated that the mill was originally constructed in 1784 for use as a grist and saw mill. <sup>17</sup>

As we can understand at this point in our Overview, the rolling mill was the third essential mechanical component of an early American mint, but a large amount of supporting equipment was also needed -- a low temperature furnace to anneal the copper, a much hotter furnace to melt it, and pouring devices and molds in order to cast the ingots. The rolling mill operations probably required more floor space and storage area (for fuel and for copper scrap) than the rest of the enterprise combined, especially when the requirements for the power source are considered, whether a water wheel or horse powered wheel.

At this point it also becomes rather obvious that the establishment of an early American mint was no small endeavor. Far more was required than just a coinage press in a back room as seems to be the visualization of some modern writers. It seems very reasonable to assume that a rather substantial effort was necessary in terms of time, cost and physical plant, and that once all of these elements were brought together the resulting facility might well be used for business activities in addition to the coinage. <sup>18</sup>

One other machine seems to have been in general use but has not been discussed before. In his description of the Machin operations, Thomas N. Machin mentioned the use of a cylinder filled with sand, sawdust and water in which the blank planchets were placed and then generally left revolving through the night -- "one night in the cylinder would wear the edges of the blanks smooth." <sup>19</sup> Thompson also mentions such a device and provides us with a small sketch.



Thompson's Polishing Wheel for Copper Planchets

After the planchets are cut to size, Thompson says "... they are nealed again and put into pickle, and they are then put into this wheel with cuttings of leather to make them very clean, the door is shut, and the wheel kept turning till they become very bright and fit for the dies. Then they are brought to the press No. 8 to receive the impression which finishes them ..." Thompson says that his wheel was used only for copper planchets, not for gold or silver. Apparently the polished steel rollers applied an adequate gloss to the surface of these materials.

Two important questions are raised at this point. Could the early American coiners have had access to polished steel rollers, and were planchet polishing wheels actually used in the polishing of planchets? In the case of the Fugio and Connecticut coinages produced by Abel Buell the answer to both questions appears to be no! For the New Jersey and Vermont coinages there have not been a sufficient quantity of specimens examined with these questions in mind. The same is true for specimens believed to have issued from the mills of Captain Machin. These are good subjects for future numismatic research.

Once again we must turn to the coinage itself to find evidence supporting these answers. We have already seen the sharply edged rim crimps on Connecticut and Fugio specimens that suggest that, had they been tumbled in a polishing wheel, the edge burrs would not have remained to be crimped by the dies. As for the rollers used to produce the strip copper their evidence remains today on many examples of poorly struck coinage. Illustrated on page 809 is a Connecticut 33.20-Z.9 of 1787. Detail in the fields and borders show this to be a well struck specimen that suffered metal-flow failure during striking. The planchet did not receive proper annealing after rolling and was much too hard for good striking. As a result the metal failed to flow into and fill the opposing central cavities of the obverse and reverse dies. The result is what you see here -- in the central areas on both sides appear the original surface patterns left on the planchets by the rollers. Prior to striking the entire planchet was covered with this rough pattern transferred from the surface of the rollers as the copper passed between them.

These certainly were not polished steel rollers -- instead, these patterns are exactly what would be expected from the rough surfaces of cast iron rollers. This metal-flow failure is quite common on the Connecticut specimens, usually not to the degree illustrated here, but in all cases the pattern remaining on the coinage is the same type seen here.

Because of the marginal design of the opposing dies in the Connecticut series, and in particular the obverse 33's and Z's, where the obverse bust is in direct alignment with Ms. Liberty on the reverse, and both were cut into the dies just a bit too deeply, a large amount of copper flow from the outer edges into the central cavities was necessary to fill the dies during striking. A hard planchet, insufficient striking pressure, or a combination of both resulted in the failure of the metal to fill the dies, with the result as we have seen that the original surface of the planchet, just as it issued from the rolling operation, remains for our examination. Note



Obverse 33.20



Reverse Z.9

Original Planchet Roller Marks Remain on Finished Coin

that the fields of the specimen have been completely smoothed by the polished dies, but in those areas of the die cavities, where the metal did not flow to fill the cavity, the original surface of the planchet bearing the marks from the rollers remains. These roller marks are quite rough with many small indentations. They appear the same in varying degrees on literally hundreds of Connecticut specimens. This accumulation of evidence leads to the conclusion that the rollers used to prepare the copper strip for the Connecticut (and Fugio) coinages were not polished steel but were instead cast iron cylinders having rather rough surfaces. Similar observations are necessary for other series of early American coinages.

These roller marks should not be confused with somewhat similar markings resulting from mineral inclusions in the copper, a result of incomplete smelting. Such inclusions generally appear as parallel striations across a planchet and do not vanish in the tightly squeezed field areas as do the roller markings. In the illustration below of Connecticut Obverse 32.3 of 1787 can be seen inclusions in the copper stretching from the U in AUCTORI across the central figure to the E in CONNEC. Various scratches are also seen where someone has dug into the large inclusion across the neck of the figure. These impurities in the copper stretch out in the direction of the rolling of the ingot and are generally black or dark brown in color.



**Mineral Inclusions in Planchet**

We plan to conclude our Overview in the next issue of CNL, and - hopefully - return to our normal newsletter format. We shall discuss the most important aspect of any coinage operation -- the coinage dies, and the punches, hubs and associated tools and implements used in their manufacture. These important tools are those about which we actually know the least.

**NOTES to An Overview of Early American Coinage Technology (Continued)**

14. Douglas, Damon G. James Jarvis and the Fugio Coppers. Unpublished manuscript in the Library of The American Numismatic Society, New York, New York. See CNL sequential pages 261, 273, 285 and 578 for excerpts from the Douglas manuscript.
15. The Colonial Newsletter. Authorized Weights of Early American Coppers. Sequential pages 8-9 & 17.
16. Rutenber, E.M. History of the County of Orange: With a History of the Town and City of Newburgh. Newburgh, N.Y., 1875. Pages 211-212.
17. Ibid.
18. Douglas, Damon G. Walter Mould to James Jarvis. The Numismatist, July 1947, page 491.  
This interesting letter from Walter Mould to James Jarvis was written on February 20, 1784 and suggests very secretive plans for some sort of mutual business enterprise. That both Jarvis and Mould later became coinage contractors leads toward speculation that still remains, today, just speculation in the absence of any other documentation that they may have been planning a joint coinage operation or, perhaps, a business in addition to a coinage operation. A review of the Jarvis Marine Papers in the Connecticut State Library at Hartford has produced nothing relative to Jarvis' coinage activities. They do indicate that Jarvis was involved in many diverse business activities.
19. Trudgen, Gary A. Thomas Machin - Patriot  
Research manuscript scheduled for publication in CNL No. 66. In this biographical sketch of Captain Machin, Gary Trudgen states that Captain Machin's son, Thomas N. Machin, was born in 1785. This suggests that at the time he observed his father's coinage operations at the mills he would have been only five or six years of age. Rutenber (Note 16) does not mention the date of Machin's letter to Dr. Hough and we are uncertain of the time interval between his observations and the recollections expressed in the letter. The accuracy of observations of a five to six year old child related some years later are, of course, questionable; however, the descriptions of the machinery and their operation correspond so very well with other sources that we are inclined to give high credibility to his observations.